Paper No. 18

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KAM K. KAM,
WILLIAM C. MITCHELL, and MARK A. ARPS

Appeal No. 2000-1243
Application 08/826,112

ON BRIEF

Before MARTIN, DIXON, and GROSS, Administrative Patent Judges.

MARTIN, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 13-28, all of the pending claims. We reverse.

A. The invention

The invention is a dual-layer pre-recorded optical image storage disc employing a partially reflective layer formed of antimony sulfide, which can take the form of antimony (III) sulfide (Sb_2S_3) or antimony (V) sulfide (Sb_2S_5). Specification at 2, ll. 21-22. Figures 1 and 5, which represent two embodiments of the invention, are reproduced below.

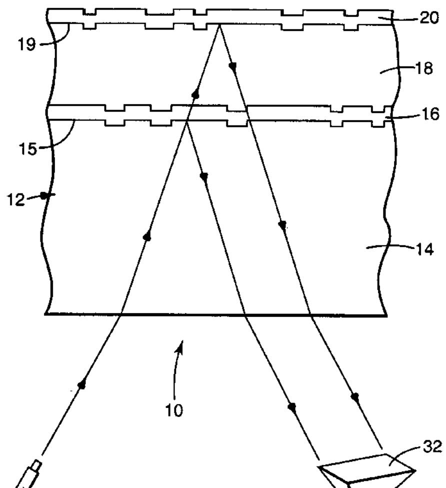

Fig. 1

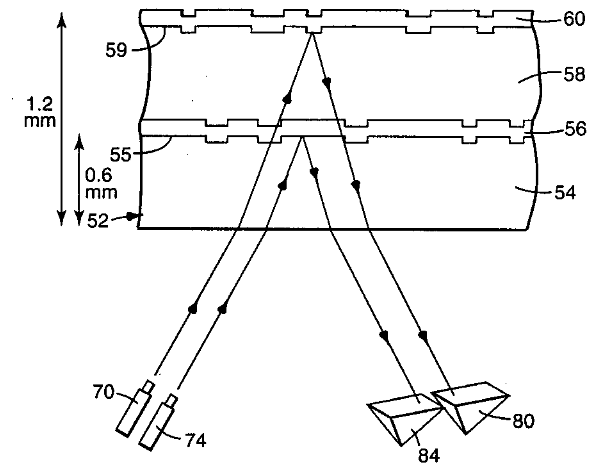

Fig. 5

In both embodiments, the partially reflective layer (16, 56) overlies a pit pattern (15, 55) formed in the upper surface of a transparent substrate (14, 54). Overlying the partially reflective layer (16, 56) is a transparent spacer layer (18, 58) whose upper surface has formed therein another pit pattern (19, 59) on which is formed a highly reflective layer (20, 60), such as aluminum. Specification at 6, ll. 3-8. The term "pit pattern" refers to "any pattern of pits or grooves that is capable of storing information, be it data, servo or tracking information, format information, etc." Id. at 4, ll. 18-20. The Figure 1 embodiment employs a single detector 32 and a single laser 30 which can be selectively focused onto either of the pit patterns. Id. at 5, ll. 4-8. In the Figure 5 embodiment, lasers 70 and 74 and detectors 80 and 84 use different wavelengths (780 nm and 650 nm) to read pit patterns 59 and 55, respectively. This permits the same disk to be read in either a standard 780 nm CD-ROM drive or in a standard 650 nm DVD-ROM drive. Id. at 3, ll. 10-20.

Figure 4, reproduced below, shows the apparent reflectivities obtained when selectively reading both layers with a wavelength of 650 nm (the Figure 1 embodiment). The filled circles represent the apparent reflectivity of the Sb_2S_3 partially reflective layer 16 and the open circles represent the apparent reflectivity of an AlCr highly reflecting layer 20. The apparent reflectivities vary by less than 0.12 over a range of thickness of the Sb_2S_3 layer from about 27 to 80 nm and are even more closely balanced over the ranges from 30 to 40 nm and 65 to 75 nm. Id. at 9, ll. 19-26.

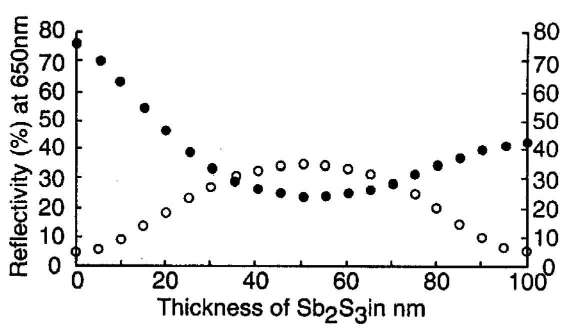

Fig. 4

Figure 6, reproduced below, shows the apparent reflectivities of the Sb_2S_3 partially reflective layer 56 as measured at 650 nm and of the AlCr highly reflective layer 60 as measured at 780 nm (the Figure 5 embodiment). For Sb_2S_3 layer thicknesses ranging between 128 and 140 nm, the reflectivities of the highly reflective layer and the partially reflective layer are greater than 70% and 20%, respectively, as required by the CD-ROM and DVD-ROM specifications. Id. at 11, ll. 15-27.

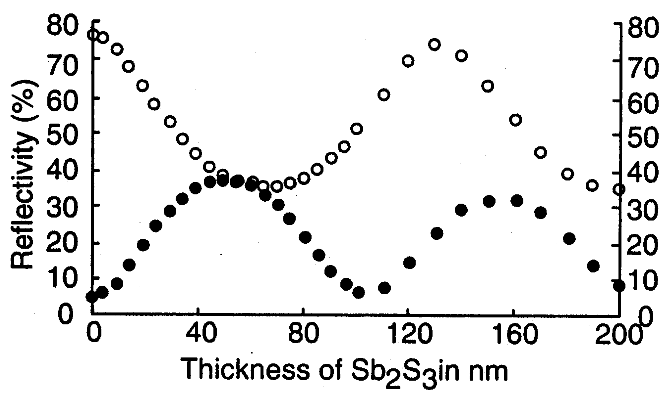

Fig. 6

The specification states that Sb_2S_3 is also desirable because of its relatively high melting point, which simplifies the process of coating by sputtering and makes the resulting film thermally stable. Id. at 11, ll. 28-30.

Appellants attribute the success of using antimony sulfide as the partially reflecting layer to the fact that its index of refraction has a high (>3.0) real component (n) for a range of wavelengths from 600 to 740 nm and a very low imaginary component

(K)[1] over a range of wavelengths from 600 to 800 nm, as shown in Figures 2 and 3 (not reproduced below). Id. at 8, ll. 3-10.

B. The claims[2]

Claim 13, which is broader than the other independent claim, claim 23, reads as follows:

> 13. A dual layer pre-recorded optical storage disc, comprising, in order:
>
> a transparent substrate having a first data pit pattern in one major surface thereof;
>
> a non-recordable partially reflective layer, adjacent the first data pit pattern, comprising antimony sulfide;
>
> a transparent spacer layer;
>
> a second data pit pattern; and
>
> a highly reflective layer provided adjacent the second data pit pattern.

In view of Horikago's teaching (discussed infra) that data can be written into an antimony sulfide layer by light having a wavelength of 400 to 500 nm, the term "non-recordable" as used in claim 13 is understood to mean that light is not used to write data into the antimony sulfide layer.

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[1] Patent No. 4,360,908 (copy enclosed) explains that the imaginary component of the index of refraction is also known as the extinction coefficient or absorption parameter (col. 5, ll. 47-52).

[2] Claim 19 is incorrectly reproduced in the Appendix to Appellants' brief: "antimony (III) sulfide" should read "antimony (V) sulfide."

C. The references and rejections

The examiner relies on the following references:

Yamada et al. (Yamada)	4,383,029 (US)	May 10, 1983
Nagashima et al. (Nagashima)	5,134,604 (US)	July 28, 1992
Horikago et al. (Horikago)[3]	6-187662 (Japan)	July 8, 1994

Dubs et al. (Dubs), "Double your capacity with DVD," September 15, 1995.

Claims 13-18, 23, and 27 stand rejected under 35 U.S.C. § 103(a) as unpatentable for obviousness over Nagashima in view of Horikago.

Claims 19 and 28 stand rejected under § 103(a) as unpatentable for obviousness over Nagashima in view of Horikago and Yamada.

Claims 20-22 and 24-26 stand rejected under § 103(a) as unpatentable for obviousness over Nagashima in view of Horikago and Dubs.

Claims 13, 22, and 23 also stand provisionally rejected for obviousness-type double patenting over independent claims 12 and 25 and dependent claim 23 of Kam et al. Application 08/826,111 considered with Horikago. Answer at 4. Because claim 23 of the

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[3] Our understanding of this reference is based on the English language translation that accompanied the declaration of inventor Mitchell, entitled "Affidavit of Dr. William C. Mitchell Under 37 C.F.R. § 132" (hereinafter "Mitchell Decl."), which was filed with Appellants' "After-Final Response" (Paper No. 10).

'111 application depends on claim 12 via claim 22, the rejection is being treated as based on claims 12, 22, 23, and 25 of the '111 application.[4]

D. The § 103(a) rejections

Nagashima's Figure 1, reproduced below, shows a dual-layer, pre-recorded, optical data medium which resembles Appellants' Figure 1 embodiment in that the same wavelength is used for reading both layers. More particularly, Nagashima's medium includes a transparent substrate 1 of glass or plastic, a semi-transparent film 3 overlying a data surface 2 of substrate 1, a transparent material layer 4 overlying a semi-transparent film 3 and having a data surface 5 therein, a non-transparent reflective film 6 overlying data surface 5, and a protection layer 10 (unnumbered in figure) over film 6 (col. 3, l. 54 to col. 4, l. 2). The type of plastic suitable for use as substrate 1 is not specified.

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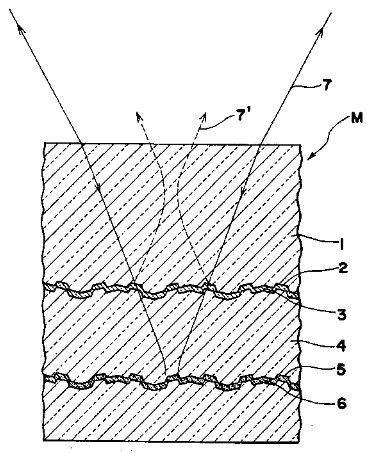
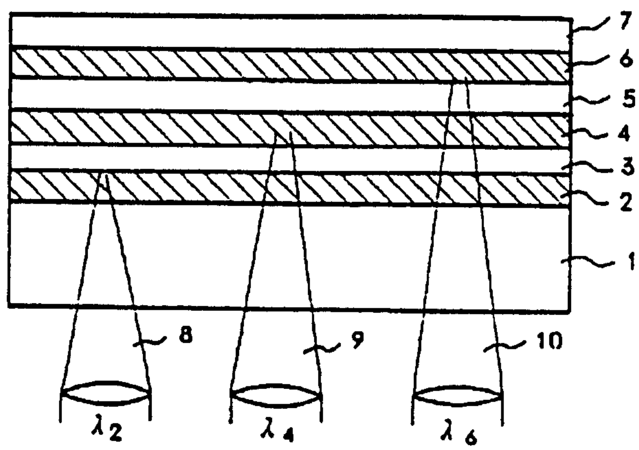
[4] The Appendix to this decision includes a copy of claims 12, 22, 23, and 25 from the '111 application as amended by the Amendment Under 37 C.F.R. § 1.116 (Paper No. 9) received on July 16, 1998, and approved for entry by the examiner in Paper No. 10 (at 2).

Fig. 1



Nagashima's discussion of semi-transparent film 3 is limited to explaining that it is formed on data surface 2 by vacuum deposition (col. 6, ll. 62-64) and is a dielectric material with a refractive index that differs from that of the transparent substrate material (col. 7, ll. 21-22). While Nagashima gives the index of refraction for the substrate as approximately 1.5 (col. 4, ll. 48-49), no value is given for the index of refraction of the semi-transparent film.

The examiner cites Horikago as evidence of the obviousness of forming Nagashima's semi-transparent film 3 of antimony sulfide. Horikago's Figure 1, reproduced below, shows an optical recording medium having three recording layers, 2, 4, and 6 responsive to respective laser beams 8-10 having wavelengths of λ_2, λ_4, and λ_6.



The transmissivities of the recording layers are described as follows:

> [R]ecording layer (2) must transmit lights of (λ_4) and (λ_6). Although it is ideal to transmit 100%, about 50% will allow operation as well. Then, although recording layer (4) must transmit light of (λ_6), it is all right whether it transmits light of (λ_2) or not. The last recording layer (6) may record and replay with laser beam of (λ_6); and it is all right that it does or does not absorb lights of (λ_2) and (λ_4).

Translation at 6, 1st full para. As regards wavelength λ_2, we understand this passage to mean that it is immaterial whether layer 2 is partially reflective and partially transmissive with respect to that wavelength, not as teaching that the materials disclosed as suitable for forming layer 2 are in fact partially reflective and partially transmissive with respect to that wavelength.

Recording layer 2 can be formed of a chalcogenide material such as Sb_2S_3, which allows recording and replay with light having a wavelength from 400 nm to 500 nm. Translation at 7, 1st para. If rewritability is required, the layer should be sandwiched between protective films in the manner shown in Figure 2 (not reproduced herein). Id. If only a "write once" capability is required, these protective films can be omitted. Id.[5] Recording layer 4 is formed of a different material from layer 2 and is capable of recording and replay with light of 600 nm, while layer 6 is formed of yet another material and is capable of recording and replay with light of 780 nm to 830 nm. Id., 2d para. Horikago additionally discloses that layer 2 can be formed on a pre-recorded pit pattern representing tracking or address signals:

> As illustrated in the Figure 1, [the invention] uses a transparent substrate (1) made of polycarbonate substrate of injection molding, transparent plastic substrate by (2P method) using UV ray curing resin, or glass substrate. Laser beams (8), (9), and (10) are entered from substrate (1) side. On these substrate surfaces (1), groove or tracking purpose or address signal pit[s] are transferred (not illustrated in the Figure 1). On this, first recording layer (2) is formed through an evaporation method or a sputtering method.

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[5] We agree with Appellants (Reply Brief at 3) that the examiner is incorrect to characterize layer 2 when used in the "write once" mode as being "non-recordable." Answer at 12.

Translation at 5, last para.

While Horikago's antimony sulfide layer is partially reflective in the sense that it reflects one wavelength (λ_2) while transmitting others (λ_4 and λ_6), it is not disclosed as being partially reflective and partially transmissive with respect to the same wavelength, as is required of the semi-transparent film (3) in Nagashima's recording medium, wherein the same wavelength is used to read the semi-transparent film and the reflective film (6). The examiner, apparently recognizing this deficiency, argues that

> [k]nowledge of this material [antimony sulfide] was clearly known by Horikago et al as the index of refraction would have been required information in the construction of the disclosed optical disc, as the index of refraction would play a critical role in the construction of an optical disc wherein more than one layer would be read. Therefore Horikago et al. teach a partially reflective layer in a dual-layer prerecorded disc with antimony sulfide.

Answer at 11. We agree with Appellants that the examiner's argument fails for two reasons. The first is that it cannot be assumed in the absence of supporting evidence that a person skilled in the art at the time the invention was made would have known the values of the real and imaginary components of the index of refraction of antimony sulfide. See In re Ahlert, 424 F.2d 1088, 1091, 165 USPQ 673, 677 (CCPA 1970):

> Assertions of technical facts in areas of esoteric technology must always be supported by citation to some reference work recognized as standard in the pertinent art and the appellant given, in the Patent Office, the opportunity to challenge the correctness of the assertion or the notoriety or repute of the cited reference. Cf. In re Cofer, 53 CCPA 830, 354 F.2d 664, 148 USPQ 268 (1966), In re Borst, 52 CCPA 1398, 345 F.2d 851, 145 USPQ 554 (1965). Allegations concerning specific "knowledge" of the prior art, which might be peculiar to a particular art should also be supported and the appellant similarly given the opportunity to make a challenge. See In re Spormann, 53 CCPA 1375, 363 F.2d 444, 150 USPQ 449 (1966).

See also In re Lee, 277 F.3d 1338, 61 USPQ2d 1430, 1435 (Fed. Cir. 2002) (noting that In re Zurko, 258 F.3d 1379, 1385, 59 USPQ2d 1693, 1697 (Fed. Cir. 2002), explains that "deficiencies of the cited references cannot be remedied by the Board's general conclusions about what is 'basic knowledge' or 'common sense'").

Second, assuming for the sake of argument that one skilled in the art would have known the values of the real and imaginary components of the index of refraction of antimony sulfide, Nagashima and Horikago fail to demonstrate that one skilled in the art would have understood those values to mean that antimony sulfide is capable of reflecting and transmitting sufficient amounts of light of the same wavelength so as to permit it be used to form the semi-transparent layer (3) in Nagashima.

Consequently, we are reversing the § 103(a) rejection of claim 13, which is based on Nagashima in view of Horikago, as well as the § 103(a) rejection of claims 14-17, 23, and 27, which is also based on only those two references.

The § 103(a) rejection of claims 19 and 27 is based on Nagashima in view of Horikago and Yamada. We agree with Appellants (Brief at 7 n.2) that Yamada, which the examiner cites for its teaching of using antimony (V), Sb_2S_5, as a recording layer, fails to cure the above-noted deficiencies in Nagashima and Horikago.

The § 103(a) rejection of the remaining claims, i.e., claims 20-22 and 24-26 is based on Nagashima in view of Horikago and Dubs, which at page 1 describes a dual-layer DVD having a semi-reflective, semi-transparent layer and a reflective layer. Dubs explains at page 1 that materials suitable for use as the semi-reflective layer include: "Metals with a very high ratio of extinction coefficient k to index of refraction n ($k/n>10$) or dielectrics with an index of refraction of more than $n=2.59$ (reflection >20%) and a small extinction coefficient ($k<0.1$)."[6] Dubs further explains that

[6] As noted above, the term "extinction coefficient" is another name for the imaginary component of the index of refraction.

> [f]or dielectric layers a different n/k relationship is necessary as compared to metals. A high reflection is created by a completely different mechanism - interference instead of conductivity. The condition is n>2.9 (for reflectivity >30%) with k as small as possible.
>
> Most dielectric layers easily reach the extinction coefficient k smaller IE-3 at 635nm but only a few of them have a refractive index higher than 2.9 at 635nm. In addition, most materials fail because of massive absorption in the UV. . . .

Dubs at 2, 1st col. Dubs also describes using a dielectric material as the semi-reflective layer in a hybrid DVD/CD-ROM:

> Dielectrics . . . are attractive because they have very low absorption and, utilizing the interference mechanism, may be used to realize a "Hybrid" disc. This disc combines a conventional CD-ROM information layer with a semitransparent DVD layer. The thickness of this semireflective layer is adjusted to realize semireflective conditions at the DVD wavelength while acting as an antireflective film at 780nm. This semireflective layer is therefore invisible in a conventional CD-ROM player.

Id. However, Dubs does not indicate that antimony sulfide, which is not mentioned at all, has the requisite index of refraction and extinction coefficient to function as a semireflective layer. Consequently, while Dubs cures the second deficiency noted above with respect to Nagashima and Horikago, viz., their failure to show that one skilled in the art would have understood the relationship of the index of refraction and the extinction coefficient to a material's suitability for use as a semireflective film, Dubs does not cure the first deficiency, viz., the failure of those references to disclose the values of the real and imaginary components of the index of refraction of antimony sulfide. As a result, we also cannot sustain the § 103(a) rejection of claims 20-22 and 24-26.

E. The provisional double patenting rejection

Claims 13, 22, and 23 stand provisionally rejected for obviousness-type double patenting over independent claims 12 and 25 and dependent claim 23 of Kam et al.'s '111 application considered with Horikago.[7] As a result of the above-noted deficiencies in Horikago, the double patenting rejection of claims 13, 22, and 23 is reversed.

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[7] As noted above, claim 23 of the '111 application depends on claim 12 via claim 22.

F. Summary

All of the rejections are reversed as to all of the appealed claims.

REVERSED

JOHN C. MARTIN Administrative Patent Judge	)	
JOSEPH L. DIXON Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
ANITA PELLMAN GROSS Administrative Patent Judge	)	

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APPENDIX

Claims 12, 22, 23, and 25 from Kam et al. Application 08/826,111

12. A dual layer pre-recorded optical storage disc, comprising, in order:

a transparent substrate having a first data pit pattern in one major surface thereof;

a partially reflective layer comprising amorphous selenium, adjacent the first data pit pattern, having an index of refraction having a real component, n, and an imaginary component, K, wherein $n > 2.6$ and $K < 0.035$ at 650 nm;

a transparent spacer layer;

a second data pit pattern; and

a highly reflective layer provided adjacent the second data pit pattern.

22. The disc of claim 12, wherein the first data pit pattern contains a format designed for use with a first disc drive having a first laser beam having a first wavelength, λ_1, and wherein the second data pit pattern contains a second different format designed for use with a second different disc drive having a second different laser beam having a second different wavelength, λ_2, where $\lambda_2 > \lambda_1$.

23. The disc of claim 22, wherein the substrate has a thickness of about 0.6 mm and the entire disc has a thickness of about 1.2 mm.

25. An optical storage system, comprising:

an optical storage medium, comprising, in order:

a transparent substrate having a pattern of pits in one major surface thereof;

a partially reflective layer comprising amorphous selenium and having an index of refraction having a real component, n, wherein $n > 2.6$, and an imaginary component, K, less than 0.035 at 650 nm;

a transparent polymer spacer layer; and

a highly reflective layer;

a focused laser beam positioned to enter the medium through the substrate;

means for adjusting focal position of the laser beam, whereby the beam may be focused on either the partially reflective layer or the highly reflective layer; and

a photodetector positioned to detect the reflected laser beam exiting the medium.